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9. Proposed by J. C. GREGG, Brazil, Indiana.

Two circles intersect in A and B . Through A two lines CAE and DAF are drawn, each passing through a centre and terminated by the circumferences. Show that $CA \times AE = DA \times AF$. [*Euclid*.]

10. Proposed by ERIC DOOLITTLE, Instructor in Mathematics, State University of Iowa, Iowa City.

If MN be any plane, and A and B any point without the plane, to find a point P , in the plane, such that $AP + PB$ shall be a minimum.

11. Proposed by Miss LECTA MILLER, B. L., Professor of Natural Science and Art, Kidder Institute, Kidder Missouri.

A gentleman's residence is at the center of his circular farm containing $a = 900$ acres. He gives to each of his $m = 7$ children an equal circular farm as large as can be made within the original farm; and he retains as large a circular farm of which his residence is the center, as can be made after the distribution. Required the area of the farms made.

12. Proposed by J. F. W. SCHEFFER, A. M., Hagerstown, Maryland.

Let OA and OB represent two variable conjugate semi-diameters of the ellipse $\frac{y^2}{a^2} + \frac{y^2}{b^2} = 1$. On the chord AB as a side describe an equilateral triangle ABC . Find the locus of C .

13. Proposed by HENRY HEATON, M. S., Atlantic, Iowa.

Through two given points to pass four spherical surfaces tangent to two given spheres.

14. Proposed by HENRY HEATON, M. S., Atlantic City, Iowa.

Through a given point to draw four circles tangent to two given circles.

15. Proposed by ISAAC L. BEVERAGE, Monterey, Virginia.

A man starts from the centre of a circular 10 acre field and walks due north a certain distance, then turns and walks south-west till he comes to the circumference, walking altogether 40 rods. How far did he walk before making the turn?

16. Proposed by H. C. WHITAKER, B. S., M. E., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania.

Three lights of intensities 2, 4 and 5 are placed respectively at points the co-ordinates of which are (0,3) (4,5) and (9,0). Find a point in the plane of the lights equally illuminated by all of them.

CALCULUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

PROBLEMS.

1. Find the moment of inertia about the origin, of the area included within the parabola $y^2 = 4ax$, the line $x + y = 4a$, and the axis of x .

[Selected from *Osborne's Differential and Integral Calculus*.]

2. Proposed by E. S. Loomis, A. M., Ph. D., Professor of Mathematics, Baldwin University, Berea, Ohio.

Show that the indeterminate form $\frac{x - \frac{2}{3} \sin x - \frac{1}{3} \tan x}{x^5} = \frac{-1}{20}$, when $x=0$.

[Ex. 51, p. 112, *Williamson's Differential Calculus*.]

3. Proposed by H. C. WHITAKER, B. S., M. E., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania.

The product of two sides of a triangle is $6000(k^2)$, the length of the bisector of the included angle is $60(b)$. What is the maximum area of the triangle, what is the greatest length of the third side, and what the total length swept over by the triangle, the bisector remaining fixed? [Selected from *Philadelphia Call*, 26 May, 1890.]

4. Proposed by J. M. COLAW, Principal of High School, Monterey, Virginia.

Three towns A , B , and C are in the same straight line. The distance from A to B is 20 miles and the distance from B to C is 80 miles. A pedestrian started from B for C and traveled at the variable rate of 10 miles an hour reciprocally as the cube root of his distance from A . In what time did he travel from B to C ?

5. Proposed by CHARLES E. MYERS, Canton, Ohio.

The volume generated by the curve whose equation is $y^2 = px$, revolving about its axis, is cut by a right cylinder whose equation is $y^2 = px - x^2$, the axis of the latter passing through the focus of the former. Find the volume common to both by the

formula $V = \iiint dx dy dz$.

6. Proposed by O. S. KIBLER, Superintendent of Schools, West Middleburg, Ohio.

A string is wound spirally twenty times around a cylinder 20 feet high and 2 feet in diameter. Through what distance will a dove fly in unwinding the string keeping it tense at all times (1) flying in the same plane and (2) not flying in the same plane?

MECHANICS.

Conducted by B. F. FINKEL, Kidder, Missouri. All contributions to this department should be sent to him.

PROBLEMS.

1. Proposed by A. M. SCRIPTURE, A. M., Principal of Schools, New Hartford, New York.

Suppose A and B to start at the same time from the same point in a level plane. A walks south, going 30 inches at a step, stepping twice in a second and beating a drum at the beginning of each step. B steps west 30 inches every time he hears the drum beat. How far apart will they be at the end of 15 minutes, if the temperature of the air is $+41^\circ$ Fahrenheit?

2. Proposed by WILLIAM SYMMONDS, A. M., Professor of Mathematics and Astronomy, Pacific College, Santa Rosa, California.

The axis of a parabola coincides with a vertical line. What is the position of that focal chord through which a body would roll down in the least time?